

2019 Sample HSC Chemistry Paper #1

General Instructions

- Reading Time - 5 minutes
- Working time - 3 hours
- Please write using black pen.
- Draw diagrams using a pencil.
- NESAs approved calculators are permitted.
- A Formula Sheet, Data Sheet and Periodic Table are supplied and attached at the back of this paper (booklet).**
- Please provide full working out in your responses to Section II questions.

****NOTE:** There will **NOT** be a Formula, Data Sheet and Periodic Table attached for this paper until I make one. So, use the one on NESAs website when attempting this paper. However, for the official paper on HSC Day, you **WILL** be provided with a formulae sheet, data sheet and periodic table attached at the back of your exam paper (booklet).

Section I - 20 marks

Section II - 80 marks

Total Marks / 100

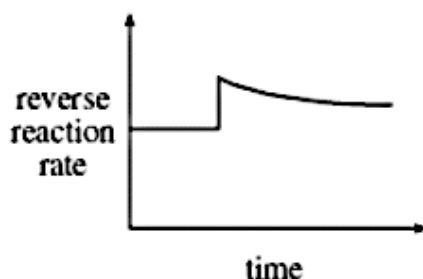
SECTION I

Question 1: Which of the following is true if the forward reaction of an equilibrium reaction is exothermic proceeding to dynamic equilibrium?

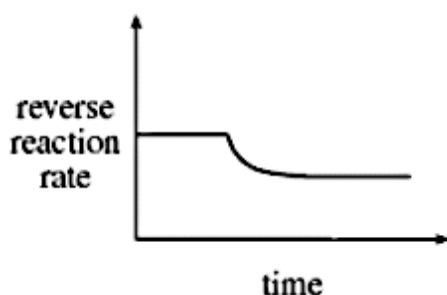
- (A) Maximum enthalpy will favour the forward reaction and maximum entropy favours the reactants.
- (B) Maximum enthalpy will favour the products and minimum entropy favours the products.
- (C) Minimum enthalpy will favour the forward reaction and the maximum entropy favours the reactants.
- (D) Minimum enthalpy will favour the products and minimum entropy will favour the reactants.

Question 2: Which of the following diagram shows the change in the rate of the reverse reaction over time is the temperature of the system is gradually reduced and eventually held constant for an exothermic reaction?

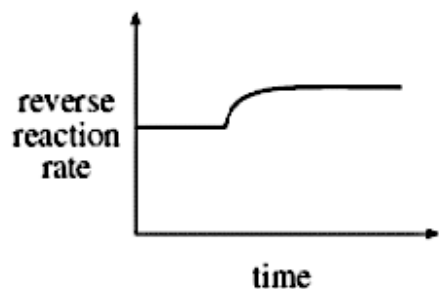
(A)



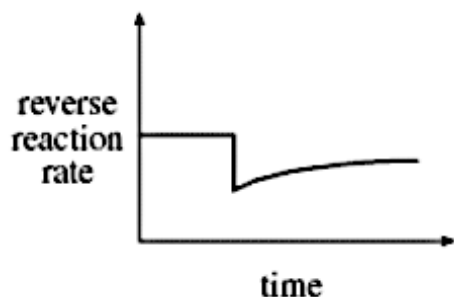
(B)



(C)



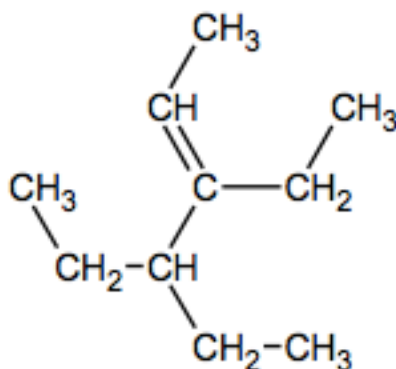
(D)



Question 3: Which of the following is not criteria of collision theory?

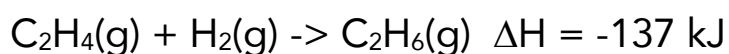
- (A) Reacting species must collide at an effective orientation
- (B) A catalyst is useful as it provides an alternative, lower energy reaction pathway for reacting species to react and form product(s).
- (C) Reacting species must collide for a reaction to take place.
- (D) The collision energy between reacting species must be greater than the activation energy of the reaction in order for a reaction to occur.

Question 4: What is the IUPAC name of the following compound?



- (A) 3,4-diethylhex-2-ene
- (B) 3-pentylpent-2-ene
- (C) 3-ethenyl-4-ethylhexane
- (D) 3,4-diethylhex-4-ene

Question 5: For the reaction



It can be said that

- (A) The total energy used to break the bonds in reactants is equal to the total energy released when the bonds are formed in the products.
- (B) The bonds broken and the bonds formed in the reaction have equal bond energies.
- (C) The total energy used to break the bonds in reactant is less than the total energy released when the bonds are formed in the products.
- (D) None of the above.

Question 6: The molar solubility of barium phosphate is 7.58×10^{-4} g/100mL of water at 25 degrees celsius. Calculate the K_{sp} for barium phosphate at the given temperature.

- (A) 3.40×10^{-23}
- (B) 5.60×10^{-23}
- (C) 4.40×10^{-23}
- (D) 8.30×10^{-22}

Question 7: The molar solubility of PbF_2 is 0.0510% (w/v) at 25 degrees celsius. Determine the K_{sp} of PbF_2 at 25 degrees celsius.

- (A) 7.2×10^{-10}
- (B) 5.7×10^{-9}
- (C) 3.6×10^{-8}
- (D) 6.5×10^{-9}

Question 8: What is the shape of C_2H_3Cl around the central carbon atoms?

- (A) Bent
- (B) Trigonal Planar
- (C) Tetrahedral
- (D) Trigonal Pyramidal

Question 9: In decreasing melting and boiling point, which of the following is correct?

- (A) Ethanoic acid, Ethanol, ethane, fluoroethane
- (B) Ethanoic acid, Ethanol, fluoroethane, ethane
- (C) Ethanol, ethanoic acid, fluoroethane, ethane
- (D) Fluroethane, ethane, ethanol, ethanoic acid

Question 10: How many sets of chemically equivalent protons are present in butanoic acid for Proton NMR?

- (A) 3
- (B) 4
- (C) 5
- (D) 6

Question 11: From start to finish, which of the following options display the correct sequential arrangement of the parts of a UV-Vis spectrophotometer?

- (A) Light source, monochromator, sample cell, detector, readout
- (B) Light source, detector, sample cell, monochromator, readout
- (C) Light source, sample cell, detector, monochromator, readout
- (D) Light source, readout, sample cell, detector, monochromator

Question 12: Which of the following is correct if there is a shift to a lower wavenumber in an IR spectrum?

- (A) A lower wavenumber on the IR spectrum corresponds to higher frequency of bond vibration.
- (B) A lower wavenumber on the IR spectrum could mean that the mass of atoms involved in the chemical bonds is higher.
- (C) A lower wavenumber could mean a shift towards lower wavelength.
- (D) A lower wavenumber must mean a decrease in peak or signal intensity.

Question 13: What is region in the electromagnetic spectrum has the wavelength of radiation between 200-400nm?

- (A) Ultraviolet
- (B) Infrared
- (C) Visible
- (D) Microwave

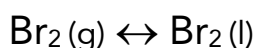
Question 14: Which of the following is incorrect about IR spectroscopy?

- (A) An unsubstituted alkene such as ethylene is infrared active.
- (B) Functional group that have similar atoms will absorb energy of the similar frequency.
- (C) The strength of the bond and the mass of the atoms involved in the infrared active bond will determine the amount of energy required to excite the molecule.
- (D) IR spectroscopy is a method that can be used to determine the structure of a molecule depending on the frequency of infrared radiation absorbed.

Question 15: Which of the following statement is incorrect in UV-Vis spectroscopy?

- (A) The absorption of UV-Vis light involves an electron making a transition from HOMO to LUMO where the energy difference between the two orbitals are equal to the energy of the UV-Vis light.
- (B) The frequency of energy in which the electron absorbs is equal to the energy difference between the HOMO and LUMO
- (C) The absorption of UV-Vis light involves an electron making a transition from LUMO to HOMO.
- (D) The absorption of UV-Vis light involves an electron making a transition from HOMO to LUMO where the energy difference between the two orbitals are equal to the frequency of the UV-Vis light.

Question 16: Which of the following K_{eq} expression is for the reaction:



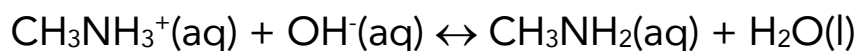
(A) $K_{eq} = \frac{\text{Br}_2(\text{l})}{\text{Br}_2(\text{g})}$

(B) $K_{eq} = \frac{\text{Br}_2(\text{g})}{\text{Br}_2(\text{l})}$

$$(C) K_{eq} = \frac{1}{Br_2(g)}$$

$$(D) K_{eq} = [Br_2(g)][Br_2(g)]$$

Question 17: For the following reaction:



The equilibrium position is most likely to lie:

- (A) on the left as water is a stronger acid than the $CH_3NH_3^+$ ion
- (B) on the left as the hydroxide ion is a stronger base than CH_3NH_2
- (C) on the right as the hydroxide ion is a stronger acid than water
- (D) on the right as the $CH_3NH_3^+$ ion is a stronger acid than water

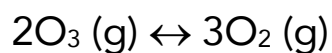
Question 18: If the forward reaction of an equilibrium reaction is exothermic, an increase in the system's temperature will result in the position of the equilibrium system to

- (A) Left and K_{eq} increases
- (B) Left and K_{eq} decreases
- (C) Right and K_{eq} increases
- (D) Right and K_{eq} increases

Question 19: In which of the following cases will a reaction not occur?

- (A) $MgCl_2(aq) + 2NaC_2H_3O_2(aq) \rightarrow Mg(C_2H_3O_2)_2(aq) + 2NaCl(aq)$
- (B) $KCl(aq) + AgNO_3(aq) \rightarrow AgCl(s) + KNO_3(aq)$
- (C) $NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l)$
- (D) $H_2SO_4(aq) + 2NaHCO_3(aq) \rightarrow Na_2SO_4(aq) + 2H_2CO_3(aq)$

Question 20: A worker added 0.060 moles of ozone gas and 0.70 moles of oxygen gas into a one litre vessel which he closed after the adding the gases.



You are given that $K_{\text{eq}} = 55$.

Which of the following is correct as the gases move towards equilibrium?

- (A) $Q_{\text{eq}} > K_{\text{eq}}$ and the $[\text{O}_2]$ increases.
- (B) $Q_{\text{eq}} < K_{\text{eq}}$ and the $[\text{O}_2]$ increases.
- (C) $Q_{\text{eq}} > K_{\text{eq}}$ and the $[\text{O}_2]$ decreases.
- (D) $Q_{\text{eq}} < K_{\text{eq}}$ and the $[\text{O}_2]$ decreases.

Question 24: Calculate the initial concentration of nitrous acid given that it has an acid dissociation constant of 6.0×10^{-4} and a pH of 3.65. **[4 marks]**

Question 25: Explain the processes involved that allow the dissolution of silver chloride in water and accounting for what happens at equilibrium. **[5 marks]**

Question 28: Describe the differences between position isomers, chain isomers and functional group isomers. **[3 marks]**

Question 29: Explain the differences in chemical properties between unsubstituted alkanes, alkenes and alkynes in terms of bonding. **[6 marks]**

Question 30: You have performed a first-hand investigation to measure the molar enthalpy of combustion of a range of alcohols in your HSC Chemistry Course.

- (i) Describe the procedure that was used. **[4 marks]**
 - (ii) Identify two safety precaution that was carried out during the experiment. **[2 marks]**
 - (iii) Provide an explanation to why the calculated enthalpy of combustion deviated from the theoretical value and how you could minimise the error. **[2 mark]**
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Question 32: Compare the applications of polytetrafluoroethylene and poly(vinyl chloride) by relating to their structure and properties. **[6 marks]**

Question 33: Evaluate the economic implications arising as a result of obtaining hydrocarbons from the Earth. [5 marks]

Question 34: Compare the mechanism of a colourimeter against a UV-Vis spectrophotometer in determining a substance’s concentration. [4 marks]

Question 35: You found four beakers in a laboratory and a note left by the previous worker noting that each of these beakers contain a different liquid being either cyclohexene, ethanol, cyclohexane or ethanoic acid. Explain the procedure that you would use to determine the liquid in each of the beakers. **[4 marks]**

Question 36: A student performed a redox titration where 0.0235L of potassium permanganate of unknown concentration was required to react with an acidified solution containing 0.020L of Fe^{2+} at a concentration of 0.121 moles per litre.

- (i) Write the oxidation and reduction half equations for the redox titration. **[2 marks]**
- (ii) Calculate the concentration of the KMnO_4 solution. **[4 marks]**

END OF EXAM

Well Done! You made it!

First, take a break. After that, you check out the following perks.

Check FULL marking criteria and sample solutions at:

<http://www.conquerhsc.com/the-hsc-cabinet/>

Discover FULL HSC Chemistry Notes (Module 5 – 8) at:

<https://www.conquerhsc.com/hsc-chemistry-syllabus-notes/>

Watch HSC Chemistry Videos on ConquerHSC's Youtube channel:

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Access your FREE Online Chemistry Tutor at:

<https://discord.gg/HdZUmfG>

Warmest,

ConquerHSC Team